A Comprehensive Geochronology Study of the Rio Grande Rise: Evidence for Prolonged On and Off-ridge Volcanism

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Intro/Scientific Problem

- Did the Rio Grande Rise form at the Paleo Mid-Atlantic Ridge with the Walvis Ridge as reconstructions suggest?
- Is the Rio Grande Rise/Walvis Ridge a Large Igneous Province and emplaced rapidly by a mantle plume head? Or does it have a more prolonged emplacement history?
- Previous to this study, only two locations from the entire Rio Grande Rise (RGR) had been sampled and yielded ages. Cruise NBP1808 was the first extensive dredging campaign to the RGR.

$^{40}Ar/^{39}Ar$ Results

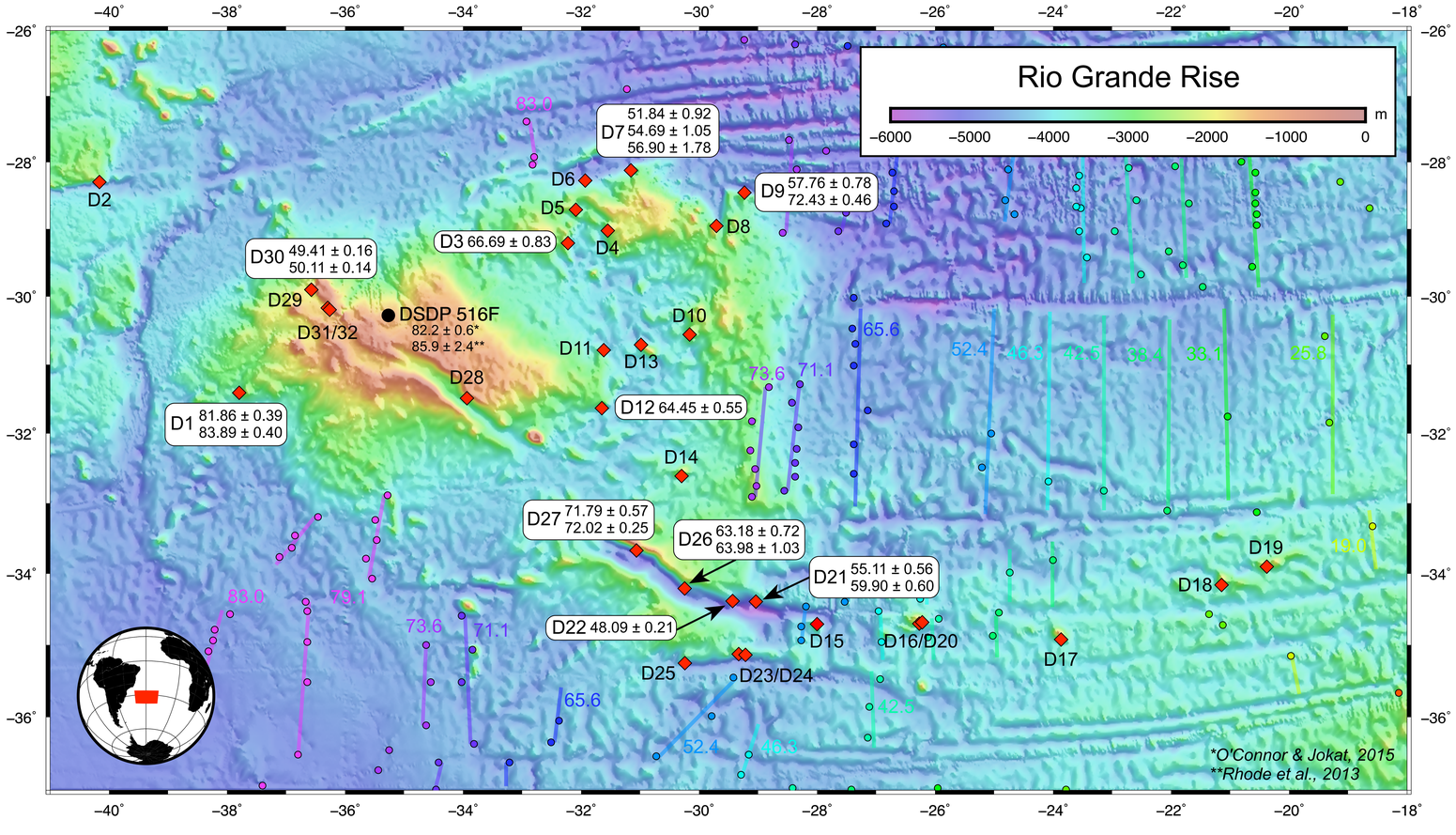
- Red diamonds are the locations of the 32 drege sites that recovered material from the Rio Grande Rise and several seamounts East of the RGR.
- $^{40}Ar/^{39}Ar$ ages from this study are shown in the white boxes in [Ma] with 2 sigma errors. Most sites with multiple ages agree within several Mya
- Colored dots are the magnetic picks of Pérez–Díaz & Eagels (2014).

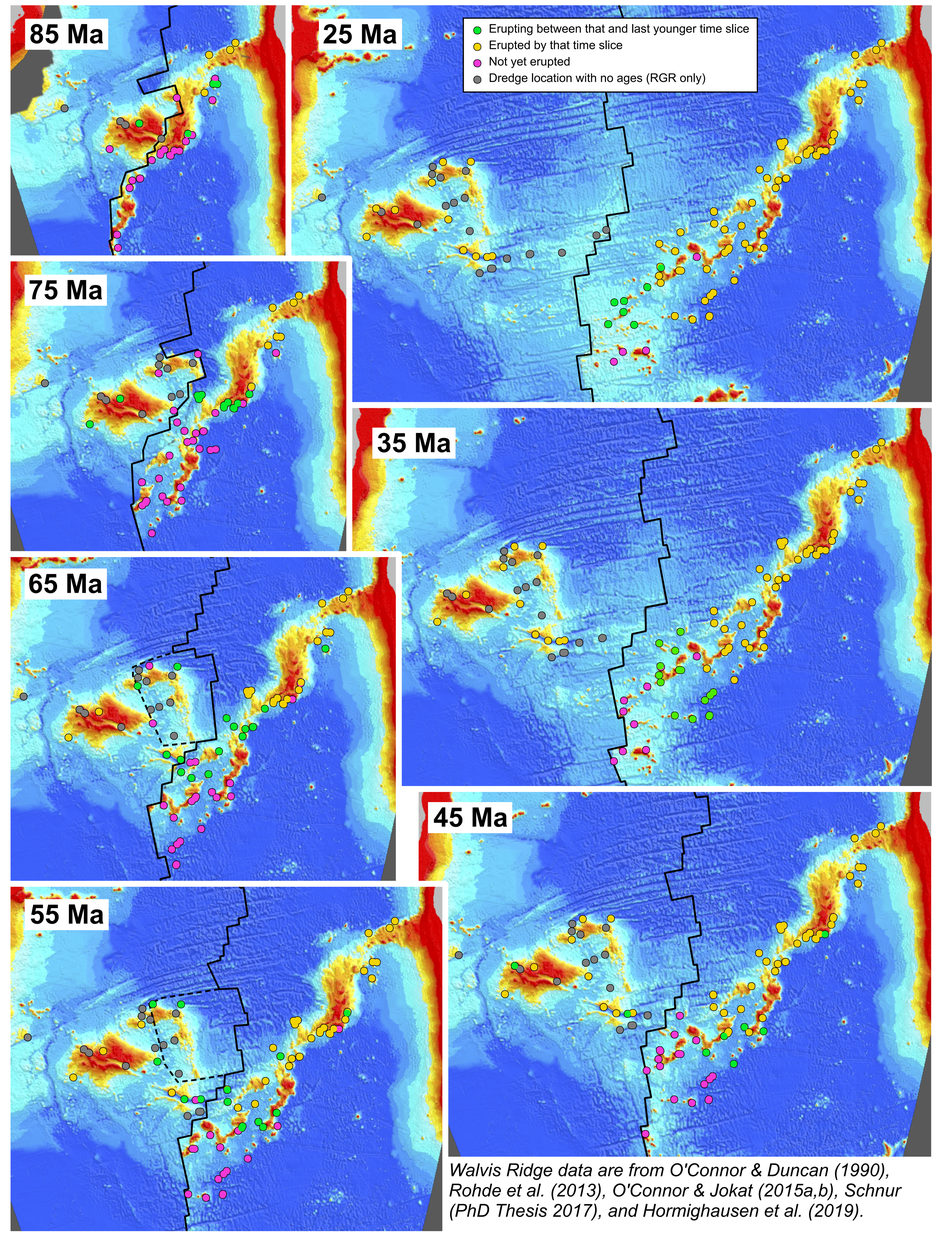
Conclusions

- The Rio Grande Rise was emplaced over a prolonged period of time, unlike many other Oceanic Plateaus such as Ontong Java Nui and Kerguelen that are classified as Large Igneous Provinces.
- The apparently off-axis volcanism in the North-eastern Rio Grande Rise could have been on-axis as a result of microplate activity during the time of its emplacement.
- Geochemistry including isotopic studies are ongoing from Conny Class at LDEO.

Reconstructions

- South Atlantic plate reconstructions between 85 and 25 Ma made in GPlates using plate rotations from Seton et al. (2012) and the locations of dated samples (see legend).
- The northwestern Rio Grande Rise erupted with the main phase of the Old Walvis Ridge at a spreading center, though more ages from both of these locations are needed to confirm the exact timing of this initial phase.
- On-axis volcanism formed the southeastern Rio Grande Rise between ~ 65 and 55 Ma while significant off-axis volcanism occured in the northeastern RGR.
- Northeastern off-axis volcanism could be the remnants of microplate activity shown with possible spreading centers as dashed black lines.
- Older undated seamounts near the South-eastern RGR likely emplaced between ~ 50 and 35 Ma in assosiation with the isotopically distinct Tristan rack though several younger seamounts appear to have been emplaced much further north at the time of their emplacement.





Walvis Ridge data are from O'Connor & Duncan (1990), Rohde et al. (2013), O'Connor & Jokat (2015a,b), Schnur (PhD Thesis 2017), and Hormighausen et al. (2019).

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